LITTLE BLUE BOOK NO. 1508
Edited by E. Haldeman-Julius

What You Should Know About Poisons

Heinz Norden

LITTLE BLUE BOOK NO. 1508
Edited by E. Haldeman-Julius

What You Should Know About Poisons

Heinz Norden

HALDEMAN-JULIUS PUBLICATIONS
GIRARD, KANSAS

Copyright 1930,
Haldeman-Julius Company

PRINTED IN THE UNITED STATES OF AMERICA

WHAT YOU SHOULD KNOW ABOUT POISONS

PART I. GENERAL TOXICOLOGY

HISTORY

The knowledge of poisons is quite old with the human race. Already the ancient Aryans of India had progressed beyond the instinctive avoidance of noxious plants so peculiar to many animals. The now almost extinct custom of burning a widow on her husband's funeral pyre is said to have been instituted by the Hindoo priesthood, in order to put an end to a vogue of husband-poisoning. Greek mythology, too, makes abundant reference to poisons, as in the case of Medea, Circe and the shirt of Nessus.

It is only natural that the ancient Egyptians with their highly developed art of embalming, and with the comparatively high state to which they had developed their knowledge of the external world, should also have a considerable knowledge of poisons. There is strong evidence that they were acquainted with prussic acid, for instance, for a papyrus preserved at the Louvre speaks of "the penalty of the peach," the plant from which this poison was originally distilled.

At the height of the Greek civilization prisoners condemned to capital punishment were executed by poison, as exemplified by Socrates who drank his draft of hemlock so heroically. The Greeks, too, gave us the first literature on poison. First came Apollodorus, who lived at the beginning of the third century B. C.

Nicander of Colophon (204-138 B. C.) already recommended the primitive antidotes that are still used today, and Dioscorides (40-90 A. D.) gave us the first classification of poisons. Pliny and Heraclitus derived most of their knowledge from Apollodorus.

From the Greeks and Egyptians the knowledge of poisons passed on to the Romans. Nero and other Roman emperors used it to get rid of undesirables, and even professional poisoners arose in the beginning of the Christian Era. At this time the infamous Locusta flourished. She supplied the poison by means of which Agrippina did away with Claudius. But later on during the Middle Ages the knowledge of poisons, together with most other knowledge, disappeared or was lost, and it is not until the Crusades that we again hear much of them. From the fifteenth to the seventeenth centuries poisoning was one of the fine arts in Italy, and it is well known how the Borgia, the Medici, and even the Popes themselves availed themselves of it. In Venice the governing "Council of Ten," solemnly deliberated and voted its use, and the records of these proceedings are still in existence.

Perhaps the most famous of all poisoners was Toffana who plied her iniquitous trade at Naples at the end of the seventeenth century. Toffana sold her "Acquetta di Napoli" in varying strengths to anybody who had the money to pay for it, and she is reputed to have been responsible for the death of more than 600 people. She was finally, in 1709, brought to justice. Another famous poisoner of this period

is Madame de Brinvilliers, about whom Victor Hugo writes.

But with the enlightenment and the growth of knowledge during the eighteenth century the heyday of poisoning was over. In its place arose the science of *toxicology*, which treats of the symptoms and detection of, in fact, everything in connection with, poisons. Scheele discovered prussic acid, probably the most swift and deadly poison of all; Lavoisier, Gay-Lussac, Davy, Marsh (the originator of the "Marsh" test for arsenic, which is still used) and many others all made valuable contributions; and finally along came Orfila, the father of modern toxicology. His great work, *Traité de Toxicologie*, appeared in 1814, and most of his processes, with improvements and modifications are still being employed today. From then on the science of toxicology has steadily developed and held pace with the other sciences, until today the skilled toxicologist can determine the nature and quantity of poisonous substances under the most adverse circumstances with almost absolute certainty.

CLASSIFICATION

Due to the fact that the chemistry of many poisons has not yet been completely worked out, toxicologists are not entirely agreed how they should be classified. Kobert divided poisons according to the symptoms they produced and this classification was simplified by Underhill into three great divisions: 1. Irritants (poisons that physically attack the portion of the body with which they come in contact); 2. Nerve

Poisons; and 3. Blood Poisons. Blyth makes the divisions according to the steps taken by the chemist to discover the poison. And, of course, one may divide according to the physical properties of the poisons themselves: Acids and Alkalies; Metals; Gases; Alkaloids; Volatile Organic Compounds, and Miscellaneous Poisons. For a booklet the size of this the matter of classification is relatively unimportant.

CONDITIONS MODIFYING THE EFFECTS OF POISON

Physical State—A gaseous poison is more readily absorbed than a liquid or solid one. It is also obvious that the toxic action of a poison depends largely on its solubility. No completely insoluble substance can be called a true poison. Except for the corrosives, dilution tends to hasten the absorption, and thus intensify the action, of poisons. Again, the larger the dose, the severer the effects will be, except where an overdose causes vomiting and thus elimination. Alcoholic solutions are more readily absorbed than those in water, and aqueous ones better than oily ones.

Path of Absorption—In general the manner in which a poison enters the body has little influence on its effects. The time after which symptoms appear is usually longer when poison is taken by mouth than when it enters through a lesion in the skin. Injection directly into the blood stream works most rapidly of all. Some poisons, however, (snake venom, arrow poison, toxic proteins) are entirely harmless when taken by way of mouth, as they are at once disintegrated by the gastric juices.

Qualities of the Organism—The action of the poison is materially affected by the characteristics of the subject to whom it is administered. Age seems to increase the body's powers of resistance against poison. Most sleep-inducing drugs act much more severely on children than on adults. Again in old age a dose of poison harmless to a person in his prime may be fatal.

Idiosyncrasy is a term applied to abnormal reactions of individuals to certain substances, toxic or not. Practically everybody is familiar with cases where certain people are unable to eat strawberries, eggs, etc., without more or less serious consequences. In extreme cases even the smell of the distasteful substance is sufficient to give rise to unpleasant symptoms. Idiosyncrasies in some people cause poisons to have effects opposite to those expected.

Habit is another factor influencing the action of poisons. If small doses are first given, and these gradually increased the body seems to develop some peculiar resistance against the poison. Just how this is effected is still somewhat of a puzzle, but it is a fact that habitual takers of drugs, in order to receive any stimulation at all, require doses that would be rapidly fatal to the normal being. This tolerance always has a definite limit beyond which death takes place even in the drug addict. Also, habit cannot be acquired with all poisons. Arsenic and alkaloids are the best examples of habit-forming poisons.

In some people it is not even necessary that they become accustomed to the poison. They exhibit a sort of natural immunity to it, which

is called tolerance. The cause of this peculiar phenomenon is as yet unknown. It is substantiated by many examples, some of them historical. Thus it is said that King Mithridates of Pontus was immune to poison, and, in more recent times, there is the famous case of Rasputin, the Russian miracle monk. Prince Youssoupoff and others conspired to kill him, but the poison had no effect and they had to resort to the gun.

Lastly the state of health of the subject affects the action of a poison. As is to be expected a poison makes headway more rapidly in a sick organism than in a healthy one. Over and above that, however, certain diseases and abnormal conditions are associated with either predisposition or increased resistance for certain poisons. We must be satisfied with merely noting this fact in passing, as the subject is too complicated to be treated here in full.

WHAT HAPPENS TO POISONS IN THE BODY

The body tends to eliminate noxious substances as quickly as possible by all means that are at its disposal. The kidney, the bowels, the lungs, the skin, all figure in this process of elimination and thus are sometimes seriously injured by the poison. Most organic compounds are chemically changed in passing through the body.

WHAT TO DO IN CASE OF POISONING

We shall not stop here to consider just how one may diagnose poisoning. Sometimes it is very difficult to distinguish between acute dis-

ease and poisoning. In general, however, when someone in apparently good health exhibits alarming symptoms after having taken in some suspicious substances, poisoning may always be suspected.

The most important and first thing to do is to call a reputable physican as quickly as possible. Speed is very essential because of the rapid action of some common poisons.

First aid consists of:

Removal of the Poison.—Where the poison has been externally applied the skin should be rinsed freely with water or alcohol (if the poison is not soluble in water). Antidotes (see further on) may be mixed with the fluid.

Most poisons, however, are taken by way of mouth, so cleansing the stomach is nearly always indicated. The only exceptions to this rule are the corrosives (strong acids and alkalies) where the mucous membranes have been injured, and strychnine. Evacuation of the stomach may be accomplished in two ways: by the administration of emetics (vomit-inducing substances) or by washing out with the stomach pump. The famous emergency emetic is ground mustard, about a teaspoonful to a cup of tepid water. Zinc or copper sulphate serve as safe and efficient emetics. The dose of zinc sulphate is 2 grams in a glass of water; for copper ½ gram at once, or three doses of 0.3 grams, fifteen minutes apart. If resistance is offered recourse must be taken to the only emetic that may be injected subcutaneously (*i.e.*, under the skin), apomorphine: 5 milligrams—one-tenth grain—in 1 percent solution, equal to 0.5 cubic

centimeters. Sometimes it is necessary to clean out the entire intestinal tract. "Salts" should be used for this purpose. Enemas are of little value.

To wash out the stomach a stomach pump is generally used, but in absence of one any long piece of thin rubber tubing will serve. The tube should be swallowed by the subject and slid down as far as possible. Then water is poured in with a funnel, to fill the tube, and the outer end lowered rapidly to a point *below* the subject's stomach. The contents will then run out of themselves.

Both stomach lavage and emetics should be repeated at proper intervals.

Antidotes—Antidoes are substances that neutralize a poison by altering its chemical or physical state. Since many antidotes are poisonous themselves, emetics must be given along, or immediately after them. The layman had best restrict himself to administering the simple household antidotes and let the physician do the rest. Antidotes are listed for each poison later in this book, so we need give only a short survey here. Strong tea is a good general antidote, because one of its constituents, tannin, acts as a precipitating agent. It may be given in quantities. Raw eggs, acacia, milk, boiled starch or flour also act by making poisons insoluble and thus harmless, or by enveloping them in an impenetrable membrane.

Akaloidal Poisons—15 drops of tincture of iodine in half a glass of water.

Barium—Glauber's salt or Epsom salt.

Oxalates—Chalk, lime water, whiting.

Phosphorus—Copper sulphate or old turpentine.

Acids—Weak alkalies like chalk, baking soda, soap, burnt magnesia. *Never give strong alkalies like lye or ammonia.*

Alkalies—Weak acids like lemon juice or vinegar. *Never give strong acids.*

Alkaloids, glucosides, phosphorus—Potassium permanganate, about 2 grains in a glass of water, repeatedly if vomiting occurs. *Take care to leave no crystals undissolved.*

There are many other antidotes, but most of them are dangerous, except in the hand of the physician. Hypodermic injections of oxidizing agents are indicated in hydrocyanic acid poisoning. Water or salt solution is often injected to cause urination. Bloodletting may be of value in some cases. Then there is a whole group of drugs that are distinctly antagonistic to certain poisons, although poisonous in themselves. Thus atropine is antagonistic to pilocarpine, caffeine to morphine, strychnine to nicotine, chloral to strychnine, atropine to morphine, chloroform to strychnine, etc.

Treatment of Symptoms—Respiration is one of the first functions to fail in poisoning, and great care should be taken to maintain it. Smelling salts, ammonia, whipping with wet towels, mustard plasters, hot coffee, etc., will serve this purpose. If all this fails artificial respiration must be resorted to or oxygen administered.

The heart may be stimulated by suitable drugs. Convulsions are counteracted by chloroform, and pain is controlled by anodynes.

Many poisons, besides producing the usual symptoms when suddenly taken into the body *once*, also produce symptoms that are sometime entirely different, when the individual is exposed to them *constantly*. In the former case we speak of *acute*, in the latter of *chronic* poisoning. The treatment of chronic poisoning consists of removal from the injurious influence and treatment of the various symptoms. In the next part of this book some of the chronic symptoms are given along with the acute ones.

PART II. SPECIFIC POISONS

The following individual discussions of specific poisons do not claim to be exhaustive. They are largely based on the short *Toxicology* by F. P. Underhill. Fatal periods and fatal doses have, for the most part been omitted, because they vary within such great limits. It should be distinctly understood that the symptoms listed need not all be present and that the treatment outlined should be directed by an experienced and reputable physician.

CORROSIVE ACIDS

In this group belong the mineral acids, as sulphuric, nitric, hydrochloric, hydroflouric acid, the fluorides and potassium chlorate. Pure glacial acetic acid, though not in the same chemical group causes very much the same symptoms. These substances are rarely encountered in intentional poisoning.

Symptoms—These acids destroy the tissues wherever they come in contact with them. Intense pain is felt along the gullet and in the

stomach. The mouth, tongue and throat appear highly inflamed. There may be difficulty with speech and breath due to the swelling. The vomit is black, brown or bloody. There is thirst, little urination and defecation. The stomach and intestines may become perforated. Death occurs generally from shock or from suffocation, due to the swelling of the lung tissue. Retching, vomiting, increased salivation, convulsions, are all common symptoms.

Treatment—Neutralization and dilution of the acid by means of antidotes. Weak alkalies, like carbonates, calcined magnesia, soap suds whiting, are given to neutralize. In an emergency plaster may be scratched off the wall. All antidotes must be given suspended in large volumes of fluid, water, or milk. In case no neutralizing agents are available give raw eggs with large amounts of water. Operations may be necessary to treat the injured portions of the mucous membrane and to avert the danger of asphyxiation. *Do not give emetics!*

CORROSIVE ALKALIES

In this group belong all forms of soda, potash and ammonia. The symptoms to which they give rise, greatly resemble those produced by the corrosive acids.

Symptoms—The tissues that have come in contact with the alkali present a whitish, gelatinous appearance. There is a nauseating soapy taste in the mouth. Severe pain in the mouth throat and stomach, which later becomes of a colicky nature. The abdomen is very tender. The vomit contains blood and mucous shreds. Respiration and speech may be difficult. The

face has an extremely anxious expression. The pulse is rapid and feeble and the body bathed in perspiration although cold to the touch. Death occurs from the same causes as with the acids, or by starvation, due to obstruction of the esophagus.

Treatment—Neutralization of the alkali by means of weak acids: lemon juice and vinegar, given in large quantities of liquid. *It is dangerous to use the stomach pump or to give an emetic!* Injuries should be treated in the usual manner.

PHOSPHORUS

Only the waxy yellow phosphorus which is kept under water (to avoid spontaneous combustion—it takes fire at 50° C.) is poisonous. The red, amorphous variety is harmless. Phosphorus poisoning is much less common today than it used to be in the days of phosphorus-matches. It is nearly always accompanied by jaundice and changes in the blood.

Symptoms—Garlic-taste in the mouth, burning sensation in the throat, pains in the stomach and thirst. There may be vomiting and purging and the breath may be phosphorescent (shine in the dark). The vomit, too, may emit light in the dark, and contain blood and mucus. There is much perspiration and weakness and death may result at this early stage from collapse. Mostly, however, an apparent recovery takes place. Jaundice soon sets in, there are frequent hemorrhages, headaches, sleeplessness, itching skin-eruptions, subnormal temperature, great prostration, rapid, feeble pulse, abnormal urine, delirium, convulsions, and coma which

finally ends in death. Very small quantities of phosphorus already are fatal. The fatal period is from one hour to many weeks.

Treatment—Stomach tube and lavage with 1 percent potassium permanganate solution. A 1 to 3 percent solution of hydrogen peroxide is even better. Oil and old turpentine should be given, the latter about one dram to a pint of water, frequently repeated. All these substances tend to render the ingested phosphorus harmless. Copper sulphate is also of value but must be used with caution so as not to aggravate the inflammation of the stomach.

CARBON MONOXIDE

Carbon monoxide is one of the most insidious of all poisons. It is a colorless, odorless gas, arising from incomplete combustion. It is present in considerable quantities in illuminating gas and in the exhaust gases of explosive motors and is frequently encountered in badly burning stoves. Its action is swift and without warning. The unsuspecting victim becomes unconscious and may never wake up again.

Symptoms—There may at first be a short period of stimulation. This is followed by headache, giddiness, throbbing of the temples, nausea. The heart first beats very violently, then the pulse becomes rapid and small. Breathing is deep and difficult. Unconsciousness sets in very rapidly. The muscles are partly paralyzed, the face red. If death does not occur, the symptoms resemble those of a violent infectious fever, or of drunkenness. There is loss of memory and intellect, weakness, fainting, perhaps convulsions. Red spots show on the

skin, and there are extended patches of bluish-red color. The body temperature may be subnormal. The blood may assume a peculiar cherry-red color, due to the fact that carbon monoxide unites chemically with the blood. Sometimes there is instantaneous recovery with no memory of his condition on the part of the subject. Local inflammations which pass into gangrene may result. Pneumonia is also frequently a sequel. With chronic poisoning the symptoms are largely those of anemia.

Treatment—In order to be effective treatment must take place at once. Remove the patient to the fresh air. *Do not be alarmed if breathing should stop for a short period.* Administer oxygen with 10 percent carbon dioxide. If this is not available resort to artificial respiration. Blood transfusion has proved very effective. Chances for recovery are usually slim if unconsciousness persists for more than two days and if patches appear on the skin.

Even a small car produces 1, and a large car or truck 2 to 3 cubic feet of carbon monoxide a minute in a small garage. This may charge the atmosphere of a closed garage to a deadly extent within a very few minutes. Always remember that there is no warning with carbon monoxide. The first thing you know is when your legs give way beneath you, and if chance doesn't bring someone along you are lost. *Moral: Never let your car run idle in a closed garage!*

WAR GASES

Into this group belong chlorine, phosgene, chlorpicrin, mustard gas, palite and superpalite

or diphosgene. Some of these gases are liquid at ordinary temperatures, and those that are gaseous are much heavier than air—a necessary quality to make them suitable for warfare. There is not enough space here to describe them individually and in detail. They all effect the respiratory tract. Mustard gas also produces skinburns.

Symptoms—The symptoms vary slightly with the various gases. Chlorine irritates the eyes and all mucous membranes, causing sneezing, copious salivation and urination, retching and vomiting. Death results from asphyxiation when the respiratory tract closes because of the swelling. Phosgene causes coughing already in very small doses. There is dizziness and blueness of the face on exertion. Symptoms are delayed sometimes for several hours. Otherwise it acts much like chlorine, only causing somewhat less distress. Chlorpicrin, too, acts much like chlorine. It may cause unconsciousness, bronchitis, shortness of breath, weak, irregular heart.

Mustard gas does not produce symptoms until 4 to 16 hours after exposure and in addition to the respiratory disturbances causes ugly burns on the skin. The pathology of war gases, as it has been worked out from the experiences of the late war, is a voluminous subject. Three distinct stages of poisoning are recognized, but, again, we must, because of lack of space, forego a detailed treatment. Some of the peculiar phenomena exhibited are first a dilution and consequently a concentration of the blood.

Treatment—Treatment consists largely in re-

lief from respiratory distress. In fact it is often a case of saving the patient from drowning in the water that accumulates in his lungs (edema). Where the blood is diluted blood-letting will help, and, on the other hand, injection of salt solutions counteracts too great a concentration of the blood. These measures have to be taken promptly to promise any success. Oxygen is sometimes, but not generally, of value.

The skin-burns produced by mustard gas are scrubbed with soap and kerosene. Soap, particularly, proved itself to be an efficient remedy. Compresses of Dakin's solution of chlorinated soda, or, if that is too painful, of alum or aluminum acetate, are applied. Petrolatum dressings and baths are of help.

IODINE

Symptoms—Pain following the passage of the iodine down the alimentary tract. Vomiting, purging, extreme thirst, fainting, collapse. Look for the characteristic brown stain. One fluid dram has caused death. The fatal period varies from 1 to 6 days.

Treatment—Dilute the stomach contents with large volumes of water. Induce vomiting or use stomach tube. The specific antidote is starch which should be administered in the form of laundry starch, boiled rice, barley water, etc., as long as it is still colored blue by the stomach contents.

LEAD

The salts of this metal that most commonly cause poisoning are the acetate, ("sugar of

lead"), the carbonate ("white lead"), and the sulphate. Acute poisoning from lead is much rarer than chronic poisoning which is caused by exposure in the many industries using the metal (smelting, painting, etc.).

Acute Lead Poisoning

Symptoms—Metallic taste, intense thirst, dryness of throat. Nausea and vomit that may be milky (lead chloride). There is abdominal pain, paralysis of the gullet and stomach, either constipation or diarrhea with black stools (lead sulphide). The face is anxious, the skin dry, the breath foul, the tongue coated. The brain remains clear but there are cramps and palsies in the extremities, particularly the forearm ("wrist drop"). Perhaps the most characteristic symptom is the "blue line" on the gums. Death at this stage occurs in deep coma. Where there is apparent recovery, the symptoms of chronic lead poisoning soon set in, since lead is a cumulative poison, and is very slowly eliminated.

Treatment—Stomach lavage and emetics. Morphine and atropine to control colic and vomiting.

Chronic Lead Poisoning

Symptoms—The onset of the symptoms is very subtle, generally colic and a feeling of debility and loss of appetite. The breath is foul and the skin sallow and parched. Anemia, "blue line," "wrist drop," are other symptoms. There may be fatty degeneration of the muscles. Peculiar, so-called "basophilic" granules in the red blood corpuscles, and the presence of lead in the urine, clinch the diagnosis for the phy-

sician. Chances for recovery are good, unless there are cerebral symptoms. These consist of hallucinations, illusions, delirium, convulsions, melancholia, etc.

Treatment—The treatment is largely one of symptoms, with removal of the patient from the source of the poison. Free bowel movements must be maintained, hot baths and applications, massages and electricity are of use. Potassium iodide is used to hasten the elimination of the lead in the body. Good diet and tonics also are of service. Of late some very elaborate dietetic treatments of chronic lead poisoning have been devised, and these have shown some very promising successes.

MERCURY

Practically all the compounds of mercury are poisonous under certain conditions, but the most common sources of mercury poisoning are corrosive sublimate or bichloride of mercury and calomel. Mercury poisoning may be acute, sub-acute or chronic. Absorption may take place even through the skin.

Symptoms—Fetid breath, metallic taste, sore gums, excessive salivation. If the poisoning is caused by repeated therapeutical administration of mercury, the edges of the gums turn black, and the teeth loosen. Infection sets in, and the teeth, even the entire jaw may decay. Symptoms of corrosion are also present in the very acute cases: burning sensation, swelling, abdominal pain, vomiting white or bloody mucous matter. Death usually follows within a week, without convulsions and with consciousness maintained. There may be grave internal

symptoms: degeneration of the liver and kidneys, hemorrhages, vasomotor disturbances, etc. If the acute stage of poisoning is not fatal, it passes into the sub-acute, which is only little less serious.

Treatment—Treatment of mercury poisoning is too complicated a matter to be adequately discussed here. White of egg or milk should be given and the poison removed from the stomach. "Stomatitis," the condition of the mouth described above, should be prevented by keeping the mouth and teeth scrupulously clean with hydrogen peroxide or potassium chlorate. Chronic mercury poisoning is not discussed here at all, because it is doubtful whether any treatment has much effect on it.

ARSENIC

Arsenic was one of the earliest, and still is one of the commoner poisons. All its compounds are more or less toxic. The ones most frequently encountered are Scheele's green, Paris green, realgar, "white arsenic," or ratsbane, Pearson's and Fowler's solutions, and numerous other insecticides, rat poisons and therapeutical prescriptions. The poisoning may be of three kinds: acute, nervous and chronic.

Symptoms—The acute symptoms appear about ½ hour after ingestion and are of an inflammatory nature, difficulty in swallowing and general discomfort in the stomach. Later there is violent pain with nausea and vomiting. The vomit may be clear or contain bile and blood. Stools are first as in simple diarrhea, but later consist of small particles or shreds of mucous matter in a serous fluid. The urine may be

bloody. The skin and the extremities are cold and damp. There is headache, dizziness and cramps in the limbs. The face may be blue, the pulse feeble and the respiration weak. The patient finally passes into coma and dies from exhaustion more than anything else. If he recovers the symptoms of chronic poisoning set in. These may also be caused by repeated administrations of small doses. The chronic symptoms are: swelling and inflammation of the eyelids, a condition resembling the common cold, jaundice, skin eruptions, falling out of hair and nails, black discoloration of the skin, intestinal catarrh which may lead to ulceration. The poisoning may pass into a third stage, where general inflammation of the nerves, atrophy of the muscles, and paralysis are involved. There may even be blindness and numerous other serious symptoms. But even at this stage recovery may be possible if the poison is removed.

Nervous arsenic poisoning is quite rare, but it is so different from the usual forms that it is worth mentioning. In it the gastro-intestinal symptoms may be almost entirely absent. Instead there is a marked effect on the nervous system, manifesting itself by sleep, paralysis, mania, delirium and convulsions.

Treatment—Stomach lavage with warm water or, where that is not possible, emetics. Purging with "salts" is also recommended. The so-called "arsenic antidote" is of doubtful value. Collapse should be treated with stimulants such as caffeine and digitalis, or with warmth. Large volumes of fluid should be administered

to make up for the water lost by vomiting. In the treatment of chronic arsenic electricity is of value in combatting paralysis. The compounds of the so-called "arsphenamine" group produce effects that are not entirely understood. Treatment of these is too complicated to be included here.

ALKALOIDS

Alkaloids are complex chemical compounds derived for the most part from plants and extensively employed in therapy. They possess certain characteristics as a group although individual alkaloids may have opposite physiological effects. All of them form insoluble compounds with certain "alkaloidal reagents," chief among which is tannic acid. Alkaloids have a toxic effect particularly in regard to the nervous system.

In this group belong: coniine (hemlock), nicotine (tobacco), opium, morphine, codeine and heroine (all derived from poppy), strychnine and brucine (nux vomica), aconitine (monkshood), atropine, hyoscyamine and scopolamine (derived from plants of the potato family) veratrine, physostigmine (calabar bean), pilocarpine (jaborandi), colchicine (saffron), cocaine, ipecac, ergot (the mildew on rye), adrenalin (occurring in the suprarenal gland of animals), gelsemium (jasmine), and many other less important ones.

The complete toxicology of the alkaloids would take up too much space here. But, while their effects are quite varied, the method of

treatment is very similar: lavage of the stomach with tannic acid or other suitable reagents. Treatments of the symptoms, stimulants, etc. Many of the alkaloids are specifically antagonistic toward, and thus used against, each other.

PRUSSIC ACID

Prussic acid is probably the most deadly of all poisons. It has been known to kill in less than ten seconds. The mortality is very high—95%, and hope for recovery lies only in the greatest speed. The acid itself very rarely causes poisoning as it is hardly encountered outside the laboratory. Of its salts the most common one is potassium cyanide which is still frequently employed for purposes of suicide.

Symptoms—Where a large dose is taken there is generally no time for symptoms to manifest themselves. The individual utters a cry, falls to the ground, undergoes one or two shuddering convulsions (these even may be absent) and dies. The odor of almonds or peach blossoms is very noticeable in the breath, in fact in all the organs of a person stricken with cyanide poisoning.

Where the dose is small a number of symptoms appear but these are hardly worth mentioning since they are so rarely encountered.

Treatment—In order to have any chance of success treatment must be very swift. It consists of evacuation of the stomach and support of respiration at any cost. Antidotes usually have little effect, because the poison acts so rapidly.

CARBOLIC ACID

Symptoms—Externally applied carbolic acid turns the skin first white, then brown, also producing eczema. Internally, it causes burning pain in the mouth, throat and stomach. There may or may not be vomiting. Very characteristic is the speedy collapse which results within a few minutes. The face is pale and covered with cold sweat. There is unconsciousness, weak and rapid pulse, irregular breath, sometimes convulsions and twitchings. The pupils contract and high temperature is followed by subnormal temperature. The urine is smoky and may contain blood or bile. In the lighter forms of carbolic acid poisoning there may be excitement and slight delirium. Death may occur within a few minutes or be delayed up to 24 hours.

Treatment—The burns are washed with alcohol and oil dressings applied. The stomach should be washed out first with 10 percent alcohol, then with warm water. Potassium permanganate should be administered (*no undissolved crystals!*). White of egg may also help. Collapse should be treated with heat.

ACETANILID, PHENACETIN, ANTIPYRIN

These three drugs are very similar in action and therefore may be treated together. All of them are frequently encountered in "pain relievers."

Symptoms—Profuse perspiration, cyanosis (blueness of the skin), weakness, collapse, weak pulse, shallow breath (with difficulty), subnormal temperature. There may be uncon-

sciousness, convulsions and delirium, even acute jaundice. Death results from circulatory failure, either suddenly or after several days.

Treatment—Stomach evacuation and purging with "salts." Give stimulants such as strychnine, camphor, brandy, ammonia, warmth. Blood-letting with later injection of salt solution may be resorted to. Heart stimulants and artificial respiration may be necessary.

WOOD ALCOHOL

The effects of ordinary (ethyl) alcohol are too well known to merit special mention in a work of this scope, but since the introduction of prohibition in the United States, poisoning from wood (methyl) alcohol, which is much more toxic, has become quite common. Sad to relate much of the bootleg whiskey sold contains this insidious poison in appreciable quantity. Every once in a while the papers are full of an epidemic of wood alcohol poisoning.

Symptoms—Instead of the usual alcoholic exaltation there is depression and weakness. Other symptoms are headache, nausea, vomiting, violent abdominal pains, muscular incoordination, weak and rapid pulse, difficulty in breathing, dilated pupils, low temperature, cold, moist skin. Generally there is coma, sometimes delirium, rarely convulsions. The eyes generally become affected after two days. The eyes are painful and sensitive to pressure; there is fear of light, blurred vision, or sudden complete blindness. Vision may be regained, but is frequently again permanently lost. Death may be delayed for several days.

Treatment—Evacuation of the stomach and repeated lavage with warm water. Stimulants and anodynes are indicated. The eye symptoms are supposed to be relieved by pilocarpine, potassium iodide, strychnine and purgatives. Mania may be controlled with hyocine. Blood-letting may relieve congestion of the lungs.

CHLORAL

Chloral and its more common hydrate are used in sleep-inducing drugs and also in the so-called "knock-out drops." Poisoning has frequently resulted. Chloral is a habit-forming drug.

Symptoms—These are generally absent, because a heavy sleep, from which he never awakens, engulfs the victim. Sometimes there is nausea, vomiting, delirium, convulsions and the by now familiar set of poison symptoms.

Treatment—Evacuation of the stomach (emetics are doubtful because of the depression caused by chloral). Injection of strychnine, atropine or camphor is indicated. Coffee by mouth and rectum is useful. The low temperature caused by chloral must be counteracted by hot applications. Artificial respiration may be necessary.

DIGITALIS

Digitalis is derived from the foxglove and consists of a mixture of various complex chemical compounds known as *glucosides*. In this same group belong strophanthin and oubain. These compounds are of the greatest value in treating various afflictions of the heart. Their value is so great that sometimes poisoning is

deliberately risked in order to obtain the beneficial effects on the heart that only digitalis and its allies can produce. Therefore poisoning from digitalis is not by any means rare.

Symptoms—Nausea, general ill-feeling, severe headache, diarrhea, slow and irregular heart beat, lassitude, sensory and muscular disturbances. Death does not generally occur until after a week, and is quite characteristic in respiratory convulsions.

Treatment—Stopping the drug, administration of atropine sulphate (1/65 grain—0.001 grams), sodium bromide (1 to 2 drams—4 to 8 grams), morphine sulphate (½ grain—0.015 gram). Excessive irritability may be reduced by hot water or ice over the heart. Absolute quiet and freedom from exertion *must* be maintained.

VERONAL AND LUMINAL

These two drugs which closely resemble each other are frequently used to induce sleep. They are safer, but slower, than chloral. Veronal, the more common of the two, is quite frequently used for purposes of suicide, because of the painless way in which it kills.

Symptoms—Coma, low blood pressure, weak pulse, shallow breath, increased irritability, suppressed urine, skin eruptions, asphyxia. In cases of chronic veronal poisoning there may be confusion, staggering gait, loss of memory, delusions, general debility.

Treatment—Evacution of the stomach, purging with "salts," administration of large vol-

umes of fluid to stimulate urination, camphor to raise blood pressure, bandaging of extremities, artificial respiration, if necessary.

CANTHARIDES

Cantharides is the commercial name for the drug made of the dried or the dried and powdered, blister beetle, perhaps better known as the "Spanish Fly." Its reputed "aphrodisiac" (*i. e.*, stimulating the sexual feeling) properties are doubtful, and it is rather certain that cantharidin, the active principle of cantharides, has no such effect. Cantharides is very poisonous.

Symptoms—Local irritation at the place of administration, blistering, etc. (Cantharides is also used for plasters.) If taken by mouth, burning, dryness, thirst, swelling, difficulty in swallowing. There may be salivation, nausea and vomiting, abdominal pain, blood diarrhea, pain in the sexual regions, abortion in pregnant women. The pulse is weak and slow, and there may be delirium and convulsions. Death is preceded by collapse and coma.

Treatment—The stomach must be emptied, but if the esophagus is injured so that the stomach tube cannot be passed without danger, apomorphine (the only emetic that may be given hypodermically) should be administered. Demulcent drinks and opiates to soothe pain. *No oils or fats!* Maintain body temperature and administer much fluid.

OXALIC ACID

Oxalic acid is the poison of rhubarb leaves, sorrel, dock, etc. It is familiar to most house-

wives as a remover of ink and rust strains. Owing to its swift action in large doses, and to the fact that it may be easily mistaken for other drugs, (Epsom salts, tartrate), many cases of accidental poisoning and suicide have occurred from it.

Symptoms—In large doses oxalic acid acts so rapidly that symptoms have little time to develop and treatment is hopeless. There is an acid taste and the usual symptoms of corrosion. The vomit looks like coffee-grounds. Pulse is very weak. Smaller doses act largely on the nervous system: headache, cramps, convulsions, delirium, coma, etc.

Treatment—Unlike the corrosive mineral acids, dilution does not lessen the effects of oxalic acid. Alkalies and water cannot be used, because both increase the toxicity of the poison. Powdered chalk, burnt magnesium, whiting (from the wall) may be given in water. Evacution of the stomach is necessary but the tube must be used carefully. If it cannot be used, apomorphine is indicated. Treatment must be very swift to have a chance for success.

PTOMAINE POISONING

This term is now frowned upon by scientific authorities. "Food poisoning," is suggested as more accurate. The public, however, still sticks to "ptomaine," so it is used here. Ptomaine poisoning is caused by noxious germs in the food. There are two distinct types: one caused by organisms of the paratyphoid group, and the other by *Bacillus botulinus* (sausage poisoning).

Food Poisoning by Organisms of the Paratyphoid Group

Symptoms—Gastro-intestinal disturbance, nausea, vomiting, abdominal pain, diarrhea, fever, mental depression.

Treatment—Evacution of the stomach, purging, stimulants.

Botulism

Symptoms—Indisposition, fatigue, giddiness, muscular weakness, eye disturbances, constriction of the throat, coated tongue, disturbed speech, semi-coma, loss of memory and hearing, hard and dry skin, rapid pulse, subnormal temperature. Convalescence is slow and the period of sickness may be of considerable length.

Treatment—Treatment is not very effective and the mortality very high—64%. The diagnosis of botulism is difficult as the symptoms are easily confused with those of other disturbances.

Stomach lavage and purging is indicated. The patient should be kept quiet, with simple diet and plenty of water. Strychnine, pilocarpine, digitalis and strophanthine may be used as stimulants. Oxygen administration and artificial respiration may be of help.

MUSHROOM POISONING

The fact that mushrooms are poisonous has been known from time immemorial and there are many historical instances of it. The number of mushrooms that may cause unpleasant symptoms is very great, but for our purposes it will be sufficient to discuss the two that are most common and dangerous: *Amanita Phalloides*, the "toadstool," and *Amanita Muscaria*, the "fly mushroom."

Symptoms—Phalloides does not cause symptoms for several hours. Then there is great abdominal pain, vomiting and diarrhea. The vomit and stool contains blood. These symptoms may disappear for brief pauses, only to reappear stronger than before. The suffering is very severe and leads to loss of strength. The urine is generally suppressed, there may be jaundice, cyanosis, subnormal temperature. Death is preceded by deep coma. Convulsions and delirium occur in some cases. Convalescence is slow.

Muscaria poisoning is more readily diagnosed. Soon after eating the mushrooms there is salivation, perspiration, weeping, thirst and general gastro-intestinal disturbance. The pulse is slow and irregular, the breath quick and difficult. Sometimes there are symptoms greatly resembling those of alcoholic intoxication, even delirium, convulsions and coma in some cases. In non-fatal cases sleep overtakes the patient, from which he awakens greatly weakened, but out of danger. A fact important in the diagnosis of *Muscaria* poisoning is that the pupils of the eye are contracted.

Treatment—It is important to know what type of mushroom caused the symptoms, but in any case the stomach should be washed out, or enemas given. Atropine is a specific antidote against *Muscaria*, and, since it does no harm in other cases, should be administered or enemas given. Atropine is a specific against *Phalloides*. Heat, volumes of fluid, stimulants like digitalis and strychnine are indicated.